(1) Surface and Ground Water Quality

Existing Conditions

The Highlands Act emphasizes the protection, enhancement, and restoration of water resources throughout the Highlands Region, including the ground and surface waters that support ecosystem sustainability and provide necessary water supplies for the State. In collaboration with NJDEP and its 2006 Integrated Report, the Highlands Council's analysis of the overall Highlands Region surface water quality is that, with the exception of bacterial quality, surface water quality is somewhat better in the Region than conditions statewide. The two most common designated uses for surface waters found to be impaired in the Highlands Region were primary contact recreation due to unacceptable sanitary quality (91% of assessed water body units did not support primary contact use), and aquatic life support (65% of assessed water bodies did not support the use). The most common water quality parameters in violation of the State's Surface Water Quality Standards were bacteria, temperature and phosphorus, in descending order.

Sites located within the Highlands Region were reviewed for surface water quality trends covering a time period from 1984 to 2004. Of the constituents assessed, dissolved oxygen (DO), DO saturation, and nitrate (NO_3) showed stable conditions over time. Total Dissolved Solids (TDS) and Specific Conductance displayed upward trends, indicating decreasing water quality, while ammonia (NH_3), and total phosphorous (TP) showed declining trends indicating improving water quality. Total nitrogen displayed mixed results, with four sites showing no measurable trend and three sites indicating downward trends (improving conditions).

As a result of these assessment results, NJDEP has designated a significant number of stream segments and lakes within the Highlands Region as being impaired for water quality, with most impairment related to fecal coliform bacteria, phosphorus and temperature. Some stream segments are impaired for arsenic. NJDEP, as required by the Federal Clean Water Act, has adopted regulatory, enforceable plans, known as total maximum daily loads (TMDLs), for many of these water bodies to reduce the pollutant levels and restore water quality that meets the Surface Water Quality Standards.

The map entitled *Overall Assessment Including Fish Consumption*, displays the status of designated uses for waterbodies by the 183 subwatersheds (HUC14) within the Highlands Region. The assessment displays five categories of use attainment, referred to as sublists. Sublist 1, shown in tan, indicates attainment of designated uses with no use threatened. Sublist 2, shown in green, indicates that some uses are attained and no use is threatened (note there are no Sublist 2 subwatersheds in the Region). Sublist 3, shown in yellow, indicates there is not enough or no data available to determine attainment status. Sublist 4, shown in purple, indicates impairments or threats, but no TMDL is required. There are subcategories within Sublist 4 as follows: 1) a TMDL has been developed; 2) other pollution control measures are expected to result in attainment in the near future; or 3) that the impairment is caused by pollution (e.g., resulting from habitat degradation) but not by a pollutant. Sublist 5, shown in red, indicates that the waterbody is impaired or threatened for one or more designated uses by a pollutant and requires a TMDL. In the Highlands Region, 119 subwatersheds have been determined to be impaired or threatened.

Glacial aquifer water quality in the Highlands Region varies, as these aquifers tend to be exposed at the land surface and are therefore more vulnerable to pollution from intentional, incidental, and accidental pollutant discharges from past and existing land uses. These pollutants and land uses include nitrates from fertilizer and septic system use; oil, grease, and deicing salts from roadways; and solvents, gasoline, and other industrial chemical releases. In addition, these aquifers interchange water with adjacent streams more frequently than bedrock aquifers, which can also affect ground water quality. There is no equivalent to the TMDL process for ground water quality, but several programs exist to regulate ongoing discharges, reduce the potential for accidental discharges, and restore water quality from past pollution events.

A thorough and complete assessment of ground water quality in all the Highlands Region bedrock aquifers is not possible at this time due to a lack of available data. While ample data exists from wells in the Precambrian crystalline rock aquifers that comprise the upland areas, fewer sources of data are available from wells in the dolomites, slates, and other geologic units making up the valley floors. Given those limitations, it can be concluded that based on the available data, ground water quality in the deeper portion of the bedrock aquifers is suitable for most purposes; however, locally ground water may require treatment for undesirable characteristics (such as low or high pH) and

contaminants (such as manganese or radionuclides). Relatively low pH, alkalinity, and total dissolved solids concentrations in water from the Precambrian metamorphic crystalline rock aquifers indicate that mineral water reactivity is minimal compared to the sedimentary rock aquifers in the valleys. Such intrinsic resistance to weathering results in those metamorphic rock types being predominant in upland areas, yielding a low buffering capacity. Water in and associated with these rock types are therefore particularly vulnerable to acid rain and some other forms of contamination.

Goals and Requirements of the Highlands Act

The Highlands Act recognizes the importance of the Highlands Region as the "essential source of drinking water, providing clean and plentiful drinking water for one-half of the State's population" (Section 2). The Act also recognizes the ecological importance of clean water. The need to protect, enhance, and restore water quality is fundamental to ensuring that there are adequate water supplies to support these needs.

The Highlands Act includes a goal to "protect, restore and enhance water quality and quantity of surface and ground waters" (Sections 10(b)1 and 10(c)1). The Highlands Council's resource assessment must determine "the amount and type of human development and activity which the ecosystem of the Highlands Region can sustain while still maintaining the overall ecological values thereof, with special reference to surface and ground water quality and supply…" (Section 11.a.(1)(a)).

The Highlands Plan Approach

In furtherance of the requirements and goals of the Highlands Act, the Plan focuses on the following areas of action to address the need to protect surface and ground water quality:

- Identify surface and ground water resources currently, or at risk, of impairment and in need of protection, restoration, or enhancement
- Develop, coordinate, and leverage resource protection measures to protect, restore, and enhance water resources
- Coordinate with NJDEP in water quality assessment and developing and implementing Total Maximum Daily Loads for surface water within the Highlands

- Develop a ground water quality assessment, monitoring, and attainment program to coordinate regional planning and resource protection
- Develop an educational program and materials to further the understanding of the importance of water quality and methods of protecting water resources in the Highlands

Ground water provides most of the potable water supply within the Highlands Region and contributes to surface water supplies as well. The protection, restoration, and enhancement of ground water and surface water quality are primary goals of the Highlands Act. Methods to protect ground water and surface water quality include ensuring that development activities consider existing and potential impacts to critical water resources, such as prime ground water recharge areas, source water and wellhead protection areas, and riparian buffers for Highlands Open Waters.

The evaluation of sustainable locations and density of development, in conjunction with the use of best management practices applicable to these various water resource needs, will support the protection and management of critical lands for water quality purposes. Coordination with NJDEP and other agencies to identify impairments, and implement improved regulatory actions and management practices, will also support the water quality goals of the Highlands Act.

The Highlands Council has responsibility for determining what land uses are appropriate and sustainable in the Highlands Region and this responsibility can play a major role in determining whether to allow land uses that would involve pollutant discharges. This Plan incorporates land use related concepts for water quality protection, seeking to restrict the water quality impacts of new land uses, while seeking to minimize the potential for pollutant discharges from existing Highlands Region land uses.

In order to implement land use controls to ensure the reduction of existing pollutant loads, and minimization of pollutant loads related to new development, municipal and county master plans and development regulations must incorporate relevant provisions of any TMDLs and other water quality protection plans. Additional protection for ground water quality is discussed in the policies for wellhead protection (for public water supply wells) and nitrate background. Furthermore, the

protection of surface water quality is also addressed in the policies for Highlands Open Waters and riparian areas.

The technical basis and additional background information on surface and ground water quality can be found in the Highlands Council's report entitled *Water Resources Technical Report.*

Policies

With regard to the protection and restoration of ground and surface water quality, the Highlands Council hereby establishes policies to further the goals and requirements of the Highlands Act.

General Policies

POLICY: The Highlands Council shall incorporate relevant provisions of any TMDLs and other water quality protection plans to protect, restore, and enhance the water quality of the Highlands Region.

Site-Specific Standards

POLICY: The Highlands Council shall implement the following resource protection standards, as follows:

- Prohibit land uses that would increase pollutant loadings to waters for which TMDLs have been adopted by NJDEP unless in compliance with the relevant TMDL
- Prohibit land uses that would increase pollutant loadings to waters for which NJDEP has proposed or indicated a need for TMDLs, unless in compliance with an adopted TMDL

POLICY: The Highlands Council shall implement the following design standards, as follows:

- Require recharge of clean stormwater
- Require low impact development and other best management practices standards for stormwater management to minimize the discharge of stormwater-entrained pollutants to ground and surface waters

- Require best management practices for agricultural irrigation practices affecting ground and surface water quality

Pre-Conformance Policies

POLICY: Prior to initiation of the conformance period, and in furtherance of the Highlands Act, the Highlands Council shall take actions that include the following.

- Develop technical guidelines and procedures for low impact development and best management practices to protect ground and surface water quality
- Develop model municipal development regulations for the protection of ground and surface water quality

Conformance Policies

POLICY: During the conformance period, and in furtherance of the Highlands Act, the Highlands Council shall take actions that include the following:

- In conformance with adopted TMDLs, require that conforming municipalities and counties adopt master plans and development regulations to restrict the addition of pollutants
- Promote implementation of low impact development standards and best management practices to protect the quality of ground and surface water quality
- Require that wastewater management plans or amendments demonstrate that the proposed service area will not directly or indirectly support development that would be in violation of an adopted TMDL

Long Term Policies

POLICY: To establish long term goals to ensure continued refinement and development of the Regional Master Plan, the Highlands Council shall take actions that include the following:

- Develop a program for improving ground and surface water through retrofit or upgrades of existing land uses and related pollutant discharges, including methods for reducing the actual, or potential, discharge of pollutants

- Identify watershed areas within which ground or surface water quality may be impaired based on similarities to known areas of water pollution, but where the impairment has not been confirmed due to insufficient monitoring data
- Develop improved monitoring systems to provide supporting data for NJDEP designation of impaired status and development of TMDLs

Local Participation Policies

POLICY: To promote the understanding and support for these resource protection goals at the local level, the Highlands Council shall take actions that include the following:

- Develop educational programs for municipal officials on ordinances for ground and surface water quality protection and restoration
- Develop training and educational programs for members of municipal and county planning boards, and environmental commissions, on concepts, approaches, and methods for ground and surface water quality protection and restoration

Coordination and Consistency Policies

POLICY: To promote the active participation in the implementation of the Regional Master Plan among state and federal agencies, the Highlands Council shall take steps that include the following.

- Develop a coordinated monitoring program with NJDEP to track changes in ground and surface water quality in the Highlands Region
- Develop a coordinated program with NJDEP to incorporate relevant management provisions of new TMDLs as they are developed and adopted
- Develop technical guidance with the New Jersey Department of Agriculture to promote best management practices for water conservation, water reuse and irrigation efficiency in farm operations for the protection of ground and surface water quality

GLOSSARY

[These terms will be in the glossary at the back of the Regional Master Plan but are included here for convenience of Members during the review of this draft section].

Bedrock Aquifer - The bedrock aquifers of the Highlands include the Precambrian crystalline aquifers, as well as carbonate or limestone aquifers that are subject to dissolution, clastic aquifers of sedimentary sandstones and shales that tend to form the mountain ridges of the area, and Newark Basin aquifers, also mostly sandstones and shales, with basalt and diabase units.

Buffering Capacity - Alkalinity is a measurement of the waters buffering capacity, or its ability to absorb and neutralize acid. The more alkaline or hard the water, the less likely pH swings in the water will occur.

Designated Surface Water Uses - The Surface Water Quality Standards identify specific designated uses for the waters of the State according to their waterbody classifications. Designated uses include aquatic life, recreational, fish consumption, drinking water, industrial water supply and agricultural water supply.

Dissolved Oxygen - Measures of dissolved oxygen (DO) refer to the amount of oxygen contained in water, and define the living conditions for oxygen-requiring aquatic organisms. Oxygen has limited solubility in water. DO concentrations reflect an equilibrium between oxygen-producing processes (e.g. photosynthesis) and oxygen-consuming processes (e.g. aerobic respiration, nitrification, chemical oxidation), and the rates at which DO is added to and removed from the system by atmospheric exchange and other processes.

Glacial Aquifer - The glacial aquifers of the Highlands are composed of sand, silt and gravel, forming narrow belts that can be 300 feet thick in places and provide significant amounts of water.

Precambrian metamorphic crystalline rock aquifer - The bedrock aquifers of the Highlands are partially composed of crystalline rocks of Precambrian age that are resistant to erosion and exposed at the land surface over 65% of the Highlands Region.

Primary Contact Recreation - Recreational designated uses are applied to streams, lake bathing beaches and other coastal waters. Recreational designated uses include primary and secondary contact recreation. Primary Contact Recreation includes activities that may involve significant ingestion risks and includes, but is not limited to, wading, swimming, diving, surfing, and water skiing.

Specific Conductance - Specific Conductance (SC) is a measure of how well water can conduct an electrical current. Conductivity increases with increasing amounts of negatively or positively charged ions. SC is an indirect measure of the presence of dissolved solids such as chloride, nitrate, sulfate, phosphate, sodium, magnesium, calcium, and iron and can be used as an indicator of water pollution.

Total Dissolved Solids - Total Dissolved Solids (TDS) is a term used to define the amount of all the dissolved minerals (e.g., chlorides, sulfates) in water. High TDS levels can cause scaling, hardness, bad taste, spotting and a laxative effect when present in drinking water. The TDS concentration in aquatic systems is an important factor determining species composition and biodiversity. An increase in the TDS concentration above natural levels may be toxic to some of the more sensitive organisms present, leading to a change in biological diversity.

TMDL - A TMDL is a Total Maximum Daily Load as defined by the federal Clean Water Act and the NJ Water Quality Management Planning rules at N.J.A.C. 7:15-7, which determines the extent to which pollutant loads to a water body must be reduced to restore that water body to a water quality that complies with the Surface Water Quality Standards. A TMDL includes an allocation of allowable pollutant loads to specific point sources (Wasteload Allocations) and categories of non-point sources (Load Allocations), after subtraction of a Margin of Safety and, where appropriate a Reserve Capacity (for future pollutant loads).